**Year 11 ATAR Chemistry**

Task 2: Atomic Structure & Bonding Test

Weighting: 5% of Year Grade

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TEACHER’S NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Required Resources:**

Blue or Black pen, Ruler, Calculator, Chemistry Data Book

**Not Allowed:**

Notes, Personal Periodic Tables

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| --- | --- | --- | --- |
| **SECTION** | **NUMBER OF QUESTIONS** | **AVAILABLE MARKS** | **MARK** |
| Multiple Choice | 10 | 10 |  |
| Short Answer | 18 | 50 |  |

**SECTION A: MULTIPLE CHOICE SECTION (10 marks)**

INSTRUCTIONS

For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. For example, is b is your answer:

If you make a mistake, place a cross through the square and shade your new answer, for example d:

If you then want to use your first answer b, cross out d and circle b:

Text

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Text

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1. The following diagram shows the first five ionisation energies of element X.

Chart, line chart

Description automatically generated

Element X has how many valence electrons?

1. 4
2. 3
3. 8
4. 1
5. Which separation technique is most useful for separating a mixture of two liquids with differing boiling points?
6. Filtration and evaporation
7. Distillation
8. Gravity separation
9. Centrifugation
10. Carbon atoms exist in nature with mass numbers 12, 13 and 14. Which one of the following is an incorrect statement?
11. The different carbon atoms in nature are called isotopes.
12. All of the carbon atoms in nature have the same number of neutrons in the nucleus.
13. All the isotopes of carbon in nature have identical chemical properties.
14. All of the carbon atoms in nature have the same number of protons in the nucleus.
15. The combination of the aluminium ion and the sulfate ion can be represented by the ionic formula:
16. Al2(SO3)3
17. Al3(SO4)2
18. Al2(SO4)3
19. Al3(SO3)2
20. The purpose of a photomultiplier tube in an atomic absorption spectrometer is to:
    1. Produce a beam of light with a wavelength specific to an element.
    2. Focusses the beam of light passing through the flame into the detector.
    3. Detect light that is transmitted through the flame.
    4. Inject the sample solution into the burner slit.

**Questions 6 and 7 relate to the following table:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **No. protons** | **Electron configuration** | **Type of element** |
| Calcium | **A** | (2,8,8,2) | **B** |
| Arsenic | 33 | **C** | Metalloid |
| Argon | **D** | (2,8,8) | **E** |

1. What is represented by the letter B?
   1. Transition metal
   2. Rare earth element
   3. Alkali metal
   4. Alkaline earth metal
2. How many valence electrons are there in an atom of arsenic?
   1. 7
   2. 5
   3. 3
   4. 6
3. Which of the following pairs are structural isomers?
4. benzene and cyclohexane
5. but- 1-ene and cyclobutane
6. dichloromethane and trichloromethane
7. 2, 3-dimethylbutane and pentane
8. Which is the best definition of the term ‘electrostatic force’?
   1. The attractive or repulsive forces between charged particles.
   2. The force that hold the nuclear particles together.
   3. The force that neutrons exert on protons in the nucleus.
   4. The affinity that an atom has for electrons.
9. A molecule of a non-cyclic alkane contains 7 carbon atoms. The number of hydrogen atoms in this molecule is:
   1. 7
   2. 14
   3. 16
   4. 28

**SECTION B: SHORT ANSWER SECTION (50 marks)**

1. What is meant by the following terms:
   1. Electronegativity:

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* 1. First ionisation energy:

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(2 marks)

1. The following graph shows the trend in first ionisation energy from neon to argon.

Chart, line chart

Description automatically generated

Explain the gradual increase in first ionisation energy from sodium to argon.

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(2 marks)

1. Calculate the number of subatomic particles in the following atoms:

|  |  |  |  |
| --- | --- | --- | --- |
| **Element symbol:** | **No. of protons:** | **No. of neutrons:** | **No. of electrons:** |
| Al3+ |  |  |  |
| Zn-68 |  |  |  |

(6 marks)

1. The following diagram shows the mass spectrum for the isotopes of tin (Sn).

Chart

Description automatically generated

Calculate the relative atomic mass of tin, showing all workings. (2 marks)

1. Draw the **electron structure** and write the **electron configuration** for the following atoms:

|  |  |
| --- | --- |
| **CALCIUM** | **PHOSPHORUS** |
|  |  |
|  |  |

(4 marks)

1. Explain the trend of atomic radius across a period of the Periodic Table.

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(3 marks)

1. In regard to the element fluorine, explain why it is more electronegative than chlorine.

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(2 marks)

1. Label the following parts of an atomic absorption spectrophotometer.

Diagram

Description automatically generated

**3.**

**1.**

**2.**

(3 marks)

1. From the following pairs of anions and cations, write down the formula for the ionic compound produced:

|  |  |  |
| --- | --- | --- |
| Cation: | Anion: | Formula for ionic compound: |
| Magnesium | Nitride |  |
| Ammonium | Carbonate |  |

(2 marks)

1. Explain, referencing the structure of the substance, why potassium bromide crystals do not conduct electricity, but a solution of potassium bromide can.

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(2 marks)

1. Identify **A, B, C, D** and **E** asone of the following.

**diamond lead ethanol sodium chloride.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Substances | State at room temperature | Conductivity in solid | Conductivity in molten/liquid | Dissolves in Water |
| A | Solid | No | Yes | Yes |
| B | Liquid | No | No | Yes |
| C | Solid | No | No | No |
| D | Solid | Yes | Yes | No |

|  |  |
| --- | --- |
|  | Name |
| A |  |
| B |  |
| C |  |
| D |  |

(4 marks)

1. Write chemical equations for the following hydrocarbon reactions. **Structural formula** should be used to represent hydrocarbons.

Benzene reacting with chlorine gas in the presence of an AlCl3 catalyst: (2 marks)

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Propene reacting with bromine water. (2 marks)

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1. Draw the following cis/ trans isomers of the following compounds.

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| --- | --- | --- |
| Compound: | Cis isomer | Trans isomer |
| But-2-ene (2-butene) |  |  |
| 1,2,-dichloroethene |  |  |

(4 marks)

1. Write the name for the following hydrocarbons.

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| --- | --- |
| Chart, radar chart  Description automatically generated | Chart, radar chart  Description automatically generated |
|  |  |

(2 marks)

1. Draw the structural formulae for**:**

|  |  |
| --- | --- |
| 3-ethylcyclobutene | 3-bromo-2-methylpent-1-ene |
|  |  |

(2 marks)

1. What are the two requirements for a molecule to be polar?

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| --- |
| 1. |
|  |
| 2. |
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(2 marks)

1. Explain why metals are able to conduct electricity.

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(2 marks)

1. Aluminium can be produced by the caustic leaching of bauxite by concentrated sodium hydroxide solution, careful precipitation of aluminium oxide (Al2O3) and smelting in a high temperature furnace. What mass of bauxite which is 36.8% aluminium in composition is needed to produce 5.00 kilograms of aluminium metal? (2 marks)

**END OF TEST**